

REMARKS

The instant Remarks are presented with a Request for Continuing Examination that requests entry of Applicants' Amendment filed May 11, 2004. That Amendment addressed the sole rejection of the claims, under 35 USC § 112, second paragraph, alleging that the claims were indefinite, made in the Final Office Action of February 11, 2004.

In the Advisory Action issued May 26, 2004, the Examiner indicated that the Amendment presented May 11, 2004 would not be entered, but would be sufficient to address the rejection under 35 USC § 112, second paragraph. However, entry of the Amendment was said to raise issues of obviousness under 35 USC § 103(a) and obviousness-type double patenting over Hoshi, US Patent 6,235,847.

Accordingly, these Remarks address that issue.

Applicants submit that the invention as it is presently claimed is not *prima facie* obvious in view of Hoshi '847. The reference fails to disclose or suggest a combination of isoprene monomer units and 1,3-butadiene monomer units and the claimed isoprene monomer unit/1,3-butadiene monomer unit weight ratio. Applicants further show that these features of the invention provide results that are unexpected by one of ordinary skill in

the art who reads Hoshi '847, including its claims. Therefore the present invention is unobvious over the Hoshi '847 reference.

I. The state of the art and the features and advantages of the present invention

Applicants submit that the following background information will help to shed a proper light on the development of the present invention and the advantageous features thereof.

As discussed in the specification under "Prior Art", conventionally, various block copolymers comprising vinyl aromatic hydrocarbon monomer units and conjugated diene monomer units have been proposed; however, such conventional block copolymers have a problem in that the block copolymers have an unsatisfactory thermal stability and, hence, are susceptible to gelation during the heating thereof at high temperatures, so that shaped articles (such as a sheet) obtained from the block copolymers suffer marked occurrence of fish eyes (hereinafter, a "fish eye" is frequently referred to simply as an "FE") which are gelled masses of a resin. The occurrence of FE's in a shaped article is disadvantageous. For example, when a print is effected on the shaped article, the print inevitably becomes defective (see page 3, line 1 to page 6, line 25 of the present specification).

In this situation, the present inventors worked toward developing a block copolymer which is advantageous not only in that the block copolymer has excellent thermal stability¹, so that occurrence of gelation of the block copolymer during the molding thereof can be suppressed, but also in that the block copolymer can be advantageously used for producing a shaped article having excellent stiffness, elongation, impact resistance, transparency and heat shrinkability.

The present inventors found that found that a shaped article, which not only is free from marked occurrence of FE's, but also has excellent stiffness, elongation, impact resistance, transparency and heat shrinkability, can be produced by molding a block copolymer comprising at least two S polymer blocks, each comprising vinyl aromatic hydrocarbon monomer units, and one B polymer block or two or more B polymer blocks which contains or collectively contain isoprene monomer units and 1,3-butadiene monomer units, wherein the amount of the vinyl aromatic hydrocarbon monomer units, the total amount of the isoprene monomer units and the 1,3-butadiene monomer units, and the isoprene monomer unit/1,3-butadiene monomer unit weight ratio are

¹ That is, even when the block copolymer is heated at high temperatures, the change in the molecular weight distribution of the block copolymer due to crosslinking or breakage of polymer chains of the block copolymer is suppressed.

within respective ranges as stated in the present claims, and wherein the vinyl aromatic hydrocarbon monomer unit moiety of the block copolymer has a short segment ratio within a range also stated in the claims, the short segment ratio being defined as the weight percentage, based on the total weight of vinyl aromatic hydrocarbon monomer units contained in the block copolymer, of the vinyl aromatic hydrocarbon monomer units contained in at least one short segment consisting of 1 to 3 vinyl aromatic hydrocarbon monomer units.

The inventors have found that it is one important aspect of the invention that the block copolymer contains isoprene monomer units and 1,3-butadiene monomer units in combination, and that the isoprene monomer unit/1,3-butadiene monomer unit weight ratio is in the range of from 45/55 to 97/3.

The importance of the combined use of the isoprene monomer units and 1,3-butadiene monomer units, and the criticality of the above-mentioned isoprene monomer unit/1,3-butadiene monomer unit weight ratio are apparent from the Examples and Comparative Examples of the present application. For easy reference, the important data are excerpted from Tables 2 to 4 (at pages 51 to 55 of the present specification) with respect to Comparative Examples 1, 3 and 4 (in each of which a block copolymer having an isoprene monomer unit/1,3-butadiene monomer unit weight ratio of less

than 45/55 is used) and Examples 1, 3 to 5, 7, 9 and 11 to 13 (in each of which a block copolymer is used in an amount of from 40 to 55 % by weight as in the case of Comparative Examples 1, 3 and 4), and summarized in Table A below.

Table A

	Ex.1, 3-5, 7, 9, 11-13	Comp. Ex. 1	Comp. Ex. 3	Comp. Ex. 4
Type and amount of the styrene resin (% by weight) *1	A-1 and/or A-2 45 to 60	A-1/A-2 10/40	A-2 45	A-1/A-2 30/30
Type and amount of the block copolymer (% by weight) *1	B-1 to B-12 40 to 55	B-15 50	B-13 55	B-16 40
Isoprene/1,3-butadiene weight ratio	56/44 to 86/54	17/83	23/77	28/72
High molecular weight component ratio (% by weight)	0.5 to 0.7	6.8	4.8	3.2
Low molecular weight component ratio (% by weight)	0.3 to 0.9	1.3	1.0	2.9
Modulus in tension (kgf/cm ²)	extrusion direction direction perpendicular to the extrusion direction	12500 to 14100 11100 to 12900	8400 5000	10500 7400
Elongation at break (%)	extrusion direction direction perpendicular to the extrusion direction	45 to 90 80 to 135	150 or more 150 or more	150 or more 150 or more
Surface impact strength (kg·cm)	55 to 100	200 or more	200 or more	45
Haze (%)	0.6 to 1.0	1.6	3.9	1.8
FE	O	X	X	Δ

In the Table A:

Fish eye (FE) was evaluated as follows (see page 39, line 7 to page 40, line 3 of the present specification).

Sheets having a thickness of 0.3 mm are continuously produced for 6 hours by continuously molding a block copolymer composition or a block copolymer/styrene resin composition at an extrusion temperature of 235 °C using a 40 mm sheet extruder (i.e., an extruder for producing sheets, which has a screw having a diameter of 40 mm). With respect to each of the sheets produced at the points in time of 5 minutes and 6 hours after the start of the continuous molding, the number of FE's having a size of 0.5 mm or more observed per 300 cm² of the sheet is counted. Based on the difference in the number of FE's between the two sheets, the occurrence of FE's is evaluated as follows:

- : The difference is less than 50.
- Δ: The difference is from 50 to 100.
- X: The difference is more than 100.

The data in Table A above clearly show that the resin composition obtained in each of Examples 1, 3 to 5, 7, 9 and 11 to 13 (in which the isoprene monomer unit/1,3-butadiene monomer unit weight ratio is within the range of from 45/55 to 93/7 as stated in claim 1) not only has excellent mechanical properties,

but also has advantageously low haze (0.6 to 1.0 %) and is free from occurrence of FE.

On the other hand, the resin composition obtained in each of Comparative Examples 1, 3 and 4 (in which the isoprene monomer unit/1,3-butadiene monomer unit weight ratio less than 45/55, i.e. outside the range in claim 1) has satisfactory mechanical properties, but has disadvantageously high haze (1.6 to 1.8 %) and suffered the occurrence of FE.

Therefore, it is apparent that the combined use of the isoprene monomer units and the 1,3-butadiene monomer units and the above-mentioned specific isoprene monomer unit/1,3-butadiene monomer unit weight ratio, which combination is stated in claim 1, provide the excellent results of the present invention.

II. Addressing the Examiner's position

The Examiner states:

Hoshi et al discloses a linear block copolymer comprising at least two S polymer blocks in combination with at least two B polymer blocks. Polymer block S is a monovinyl aromatic compound such as styrene or vinyl toluene and is present in an amount of 60-95 % by weight of the block polymer. Polymer block B is a conjugated diene such as butadiene or isoprene or a combination of such dienes. The total amount of vinyl aromatic hydrocarbon blocks and conjugated diene polymer units in the linear block polymer ranges from 65-95 % by weight and 35-10 % by weight, respectively..... Hoshi is silent as to the unit weight ratios of isoprene to butadiene, but in view of the range of weight ratio of isoprene to butadiene set forth in applicant's claims, formulation of a copolymer having, for example, B polymer blocks with 50 weight % isoprene and 50 weight % butadiene would have been

obvious in view of Hoshi et al., since the patent discloses that the B blocks may be comprised of a combination of isoprene and butadiene.

As already explained above with reference to Table A, in the block copolymer of the present invention, the combined use of the isoprene monomer units and the 1,3-butadiene monomer units and the above-mentioned specific isoprene monomer unit/1,3-butadiene monomer unit weight ratio are important for achieving the excellent effects of the present invention (specifically, the block copolymer of the present invention can be advantageously used for producing a shaped article which not only is free from marked occurrence of FE's, but also has excellent stiffness, elongation, impact resistance, transparency and heat shrinkability).

On the other hand, Hoshi '847 provides no description about the importance of the combined use of the isoprene monomer unit and the 1,3-butadiene monomer units, nor about the specific isoprene monomer unit/1,3-butadiene monomer unit weight ratio.

Furthermore, isoprene is not used in the working examples of Hoshi '847. As apparent from Table A above, when the amount of isoprene is small such that the isoprene monomer unit/1,3-butadiene monomer unit weight ratio is less than 45/55, as stated in claim 1, the incidence of FE becomes large. Therefore, it is apparent that shaped articles obtained from the block copolymers produced in the Examples of Hoshi '847 suffer marked occurrence of FE's.

As explained above, Hoshi '847 provides no teaching or suggestion about at least the features of the invention that isoprene is used in combination with 1,3 butadiene and that these two ingredients are used in a particular weight ratio. Therefore, the invention as described in the claims 1-9 is not *prima facie* obvious in view of Hoshi '847.

Furthermore, the block copolymer having the features recited in claims 1-9 enjoys the advantages of low incidence of fish eye, together with excellent stiffness, elongation, impact resistance, transparency and heat shrinkability properties. These properties have been shown to result from the use of isoprene in combination with 1,3 butadiene in a weight ratio as recited in the claims. It is not apparent to the skilled artisan who reads Hoshi '847, either its disclosure or its claims, that such a result can be achieved by using isoprene and 1,3 butadiene in combination and in a weight ratio as stated in claim 1.

For all of the above reasons, the Examiner should not reject claims 1-9 under 35 USC § 103(a) or under the judicially-created doctrine of obviousness-type double patenting over Hoshi '847.

As the Amendments to the claims of May 11, 2004, and now entered, overcome the standing rejection under 35 USC § 112, second paragraph, it is believed that the present application is now in condition for allowance.

The favorable action of allowance of the present claims and passage of the application to issue is respectfully requested.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Mark J. Nuell (Reg. No. 36,623) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

Pursuant to the provisions of 37 C.F.R. §§ 1.17 and 1.136(a), Applicants respectfully petition for a three (3) month extension of time for filing a response in connection with the present application. The required fee of \$950.00 is being filed concurrently with the Request for Continued Examination.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

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